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Battery Challenge – Voltage Created Through Different Solutions

Observations and Expectations:

My partner and I hypothesized that the carrot juice would create more voltage through the copper and aluminum sheets. The class before, we had done a similar experiment, testing only one substance’s conductivity between the same two metals. The salt water had managed to light a small bulb which meant that it had to be somewhat conductive. Since boiled carrots in water seemed to be the closest substance to salt water we would experiment on, I thought that the carrot juice would be more successful. The rest of our expectations were made by the same observation.

Table shows the expectations and outcomes of our experiments. The carrot juice is the most surprising (and certain) difference. The melted chocolate is not a certain figure since we did not have enough chocolate to melt. The voltage created by 150 ml of melted chocolate with 50 ml of salt water is 0.288 volts.

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| Expectations (Most Likely to Least Likely) | Results (Most productive to Least Productive) |
| 1. Carrot Juice (melted chocolate x2) | 1. Kool-Aid (0.582 volts) |
| 2. Apple Juice | 2. Melted Chocolate ( about 0.576 volts with 0.005 v +/-) |
| 3. Kool-Aid | 3. Coke Zero (0.570) volts |
| 4. Coke Zero | 4. Apple Juice (0.465) |
| 5. Melted Chocolate | 5. Carrot Juice (0.42 volts) |

Time (seconds)

Voltage

Figure shows the voltage created by the five different solutions over time. However, I had difficulty changing the labels on the x-axis so for each number, multiply it by 3. For example, "3" on the graph is really 9 seconds.

However, the results of our experiment contradicted our expectations. The carrot juice happened to be the least conductive solutions we tested, the highest level of voltage being about 0.42 volts. The apple juice only surpassed the carrot juice by 0.045 volts, which doesn’t seem like a significant difference. However, the most conductive substance we tested was, surprisingly, the Kool-Aid mixed with salt water. The highest voltage achieved in the solution was 0.582 volts and even its current was fairly high, starting at 12.01 mA. It was followed closely by the melted chocolate (an estimated 0.576 v) and Coke Zero (0.570 v.) These results were extremely different from my expectations. I hadn’t actually considered Kool-Aid to be such a competing factor until the testing. I believe my expectations and results differ because I had reasoning backwards.

The water in the apple juice and carrot juice is not very conductive, which is easily seen. However, the experiments lead to the idea that there must have been an element in the Kool-Aid powder that was unnoticeable otherwise. Since our Kool-Aid was mixed with what we can trust to be pure water, it must have had an extra substance so that the difference between it and apple juice or carrot juice is significant. The Coke Zero does consist of small amounts of acid which surely affected the substance’s conductivity. There may also have been an element in the melted chocolate but it was indeed surprising that the chocolate made the top three of our conductors. It is also possible, and highly likely that there were errors in our experiments, especially for the melted chocolate. I’m still uncertain of our observations for that experiment but since we didn’t have enough chocolate to redo the experiment, my partner and I decided to record our possible suspicions, along with the data. The measurements for our other four measurements might have had a maximum of 5 ml +/-. We could have possibly miscalculated how much of one substance we poured into the beaker. Our voltage may have also been off by about 0.03 volts +/- since the group could have recorded or set up our metals too slowly so that we didn’t have time to look at the measuring device. Another possible factor or error that affected our experiments was the distance set between the two metals. We tried to keep the copper and aluminum sheets as farthest as possible, both touching opposite sides of the beaker but they may have floated closer to one another as we were recording the voltage.

Conclusion and Modifications:

Our experiments lead to a few possible or uncertain conclusions. The experiments show that water does not create high amounts of voltage so therefore, neither is apple juice or carrot juice which consists of high amounts of water. Also, the most general conclusion I found was that the solution in which the two metals in does affect the voltage and current of a so-called battery. However, these conclusions are strongly based on our own acute observations which seem to be not entirely accurate. So that the experiment could have been fully completed and our variables controlled, we should have had enough materials and substances of the same temperature. We should have also assigned one group member to hold the metals while the other records the information so that we would have more accurate measurements.

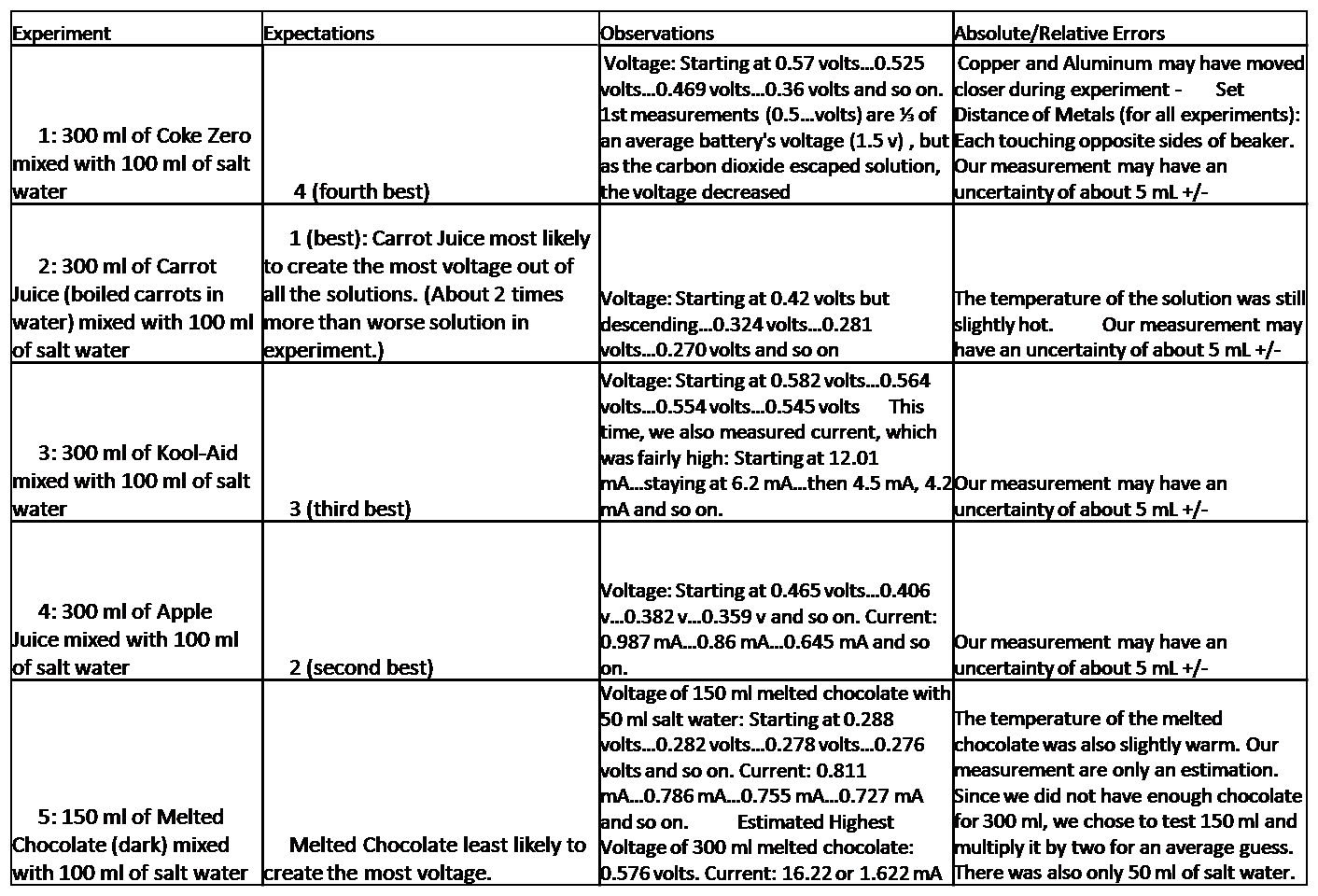


Figure shows the five experiments through the expectations, observations and errors. The main problem we had was with the melted chocolate which I mentioned before. (I'm not very good with the program Excel so please excuse any minor faults.)